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Metallic Clip Deployment during Stereotactic Breast Biopsy: Retrospective Analysis[1]

PURPOSE: To determine the visibility of presumably excised lesions on screen-film mammograms obtained after biopsy and to determine the accuracy of clip deployment on the basis of measurements obtained on routine pre- and postbiopsy mammograms.

MATERIALS AND METHODS: One hundred eleven cases of core-needle biopsy with clip deployment were reviewed. In each, the type of lesion, lesion location, and biopsy approach were recorded. Pre- and postbiopsy images were reviewed, and the distance between the clip and biopsy site was measured. Postbiopsy images were reviewed to determine whether the targeted lesion remained visible.

RESULTS: In 62 (56%) cases, the clip was located within 5 mm of the target on postbiopsy images (craniocaudal and mediolateral), while in 18 (16%), the clip was within 6–10 mm on one projection. However, 31 (28%) clips were more than 1 cm from the target on at least one postbiopsy image. Of the 111 cases, 39 (35%) were malignant or atypical and required excision. Of these, 18 (46%) had clips at least 1 cm from the targeted lesion on at least one projection.

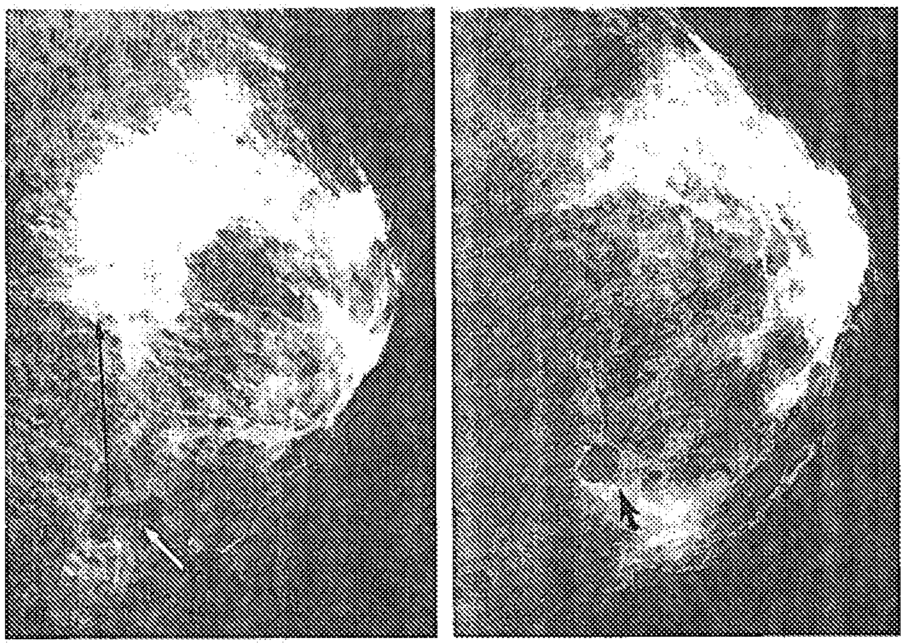
CONCLUSION: Metallic clips placed during core-needle breast biopsy are intended to mark the biopsy site when the visible lesion is excised, in case additional biopsy is required. The data suggest that the position of metallic clips placed during stereotactic core-needle biopsy may differ substantially from the location of the biopsy site. Postbiopsy mammography should be performed in two orthogonal planes to document clip position relative to the biopsy site.

One of the main advantages of vacuum-assisted biopsy needles is their ability to obtain larger volumes of tissue per sample compared with spring-activated needles (Baxter Healthcare, Valencia, Calif). Larger tissue samples improve the core-biopsy technique by reducing volume-sampling errors. One anticipated sequela of larger samples, however, is that small lesions may not be visible after biopsy (1–3). To overcome this potential limitation, stainless steel clips are often deployed at the completion of stereotactic breast biopsy to localize the biopsy site when the targeted lesion has been excised, in case additional surgery is required.

However, determination of whether a lesion is still visible after biopsy is often difficult, especially when this assessment is based solely on the digitally acquired images obtained during biopsy. This difficulty results because the digital images are obtained with limited compression, because orthogonal images cannot be obtained, and because the lesion may be partially obscured by hematoma. Therefore, it is possible that these clips are being deployed when the lesion has not been completely removed, and the residual target is visible only on dedicated screen-film mammograms obtained immediately after biopsy.

The main reason for deploying a clip is to provide a visible marker at the site of the excised biopsy target so that needle localization can be performed if indicated. To be effective, the clips must be deployed at the intended site and must remain close. However, there are limited published data on the deployment accuracy of these clips. In two separate studies, Liberman et al (4) and Reynolds (5) reported clip placement accuracy, as determined by comparing the coordinates of the clip and those of the original target on the stereotactic images. Burbank and Forcier (6) alternatively determined their initial clip placement accuracy on the basis of the mask measurement system by using mammograms obtained before and after biopsy.

Author contributions:
Guarantor of integrity of entire study, E.L.R.; study concepts and design, E.L.R.; definition of intellectual content, E.L.R.; literature research, E.L.R., T.T.V.; clinical studies, E.L.R., T.T.V.; data acquisition and analysis, E.L.R., T.T.V.; statistical analysis, E.L.R., T.T.V.; manuscript preparation, editing, review, and final version approval, E.L.R., T.T.V.



a. b.

Figure 1. Example of clip-to–biopsy site measurement on postbiopsy mammograms. Stereotactic vacuum-assisted biopsy of the original cluster of indeterminate microcalcifications in the lower inner quadrant of the left breast (not shown) was performed with an inferior approach. (a) The targeted lesion was excised, and an air-containing cavity (single-headed arrow) is depicted at the biopsy site on the postbiopsy mediolateral projection. The metallic clip is displaced cephalad. Clip displacement was determined by the distance (double-headed arrow) between the center of the original lesion and the clip along a line parallel to the plane of compression. (b) On the craniocaudal mammogram, the metallic clip is deployed within 5 mm from the biopsy site (arrow).

It has been demonstrated that the clips can be deployed near the biopsy site initially, while the patient's breast is compressed. However, as the compression is released, small discrepancies between the clip and the biopsy site may become magnified (the accordion effect), particularly in the plane perpendicular to the plane of compression used during stereotactic core-needle biopsy (4,6). Thus, small differences, as measured on postbiopsy digitally acquired stereotactic views, may result in substantial underestimation of the distance between the clip and the biopsy site on the orthogonal view. Such a discrepancy could limit the ability to accurately localize the correct area for subsequent surgery.

Because preoperative needle localization of lesions previously evaluated at biopsy with stereotactic guidance is often performed mammographically, the purpose of this study is twofold. First, this study was undertaken to determine the visibility of presumably excised lesions on postbiopsy screen-film mammograms. Second, it was undertaken to determine clip deployment accuracy on the basis of measurements obtained from routine pre- and postbiopsy mammograms.

MATERIALS AND METHODS

Between November 1, 1997, and June 30, 1999 (20 months), 258 consecutive patients were referred to our institution for stereotactic vacuum-assisted breast biopsy of mammographically suggested lesions. In all cases, biopsy was performed with a dedicated prone unit with digital imaging (StereoGuide; LoRad, Danbury, Conn) and a vacuum-assisted biopsy system with an 11-gauge biopsy probe (Mammotome; Biopsys Medical, Irvine, Calif). A minimum of six specimens were obtained from each lesion. The decision to obtain additional specimens was based on the size of the lesion, results of the specimen radiographs in cases of microcalcifications, and findings on the stereotactic images.

After biopsy, the biopsy needle was retracted at least 5 mm from the biopsy position, and a pair of stereoradiographs was obtained to determine if the mammographic lesion was excised. The stereoradiographic images were optimized by adjusting the window and level settings and by using one of the sharpening filter algorithms provided by the manufacturer for use in cases of microcalcifications. On the basis of the findings at final assessment of the stereotactic images, a marker clip was placed at the discretion of the radiologist performing the procedure. For microcalcifications, criteria for clip deployment were that the postbiopsy stereo images did not demonstrate residual microcalcifications. For masses and focal asymmetric densities, criteria for clip placement included lack of visualization of the targeted lesion due to removal or obscuration by hematoma.

In 111 (43%) of the 258 stereotactic vacuum-assisted biopsies, a tissue marker (MicroMark II; Biopsys Medical, Irvine, Calif, or Site Marker Clip; US Surgical, Norwalk, Conn) was deployed at the conclusion of the biopsy procedure to radiographically mark the location of the biopsy site. These cases constituted our study population. In all 111 cases, the marker clip was positioned at the biopsy site by using the through-probe technique (7), as described in the instruction manual.

Following clip placement, a pair of stereotactic images was obtained to confirm clip deployment. In addition, final mammographic images were also obtained in at least two projections, craniocaudal and mediolateral oblique, to verify placement and accuracy. If a prebiopsy mediolateral view was available, a corresponding postbiopsy mediolateral projection was also obtained. If a discrepancy was present between the clip and the biopsy site, it was recorded at the time of biopsy.

A retrospective review of the pre- and postbiopsy mammograms of the 111 cases of stereotactic breast biopsy with clip deployment was performed. For all cases, the type of lesion (ie, mass, density, architectural distortion, or microcalcifications), lesion size, number of cores obtained, and the biopsy approach (ie, superior or inferior or lateral or medial) were recorded. In addition, the lesion location was recorded, either by clock position or quadrant, to confirm the site of the lesion on postbiopsy mammograms.

Postbiopsy images were then examined to determine if the targeted lesion was excised, obscured by hematoma, or remained visible. The clip-to–biopsy site distance (defined as the distance from the center of the target to the clip in a line parallel to the plane of compression) was measured on craniocaudal and mediolateral oblique projections by consensus of two radiologists (T.T.V., E.L.R.).

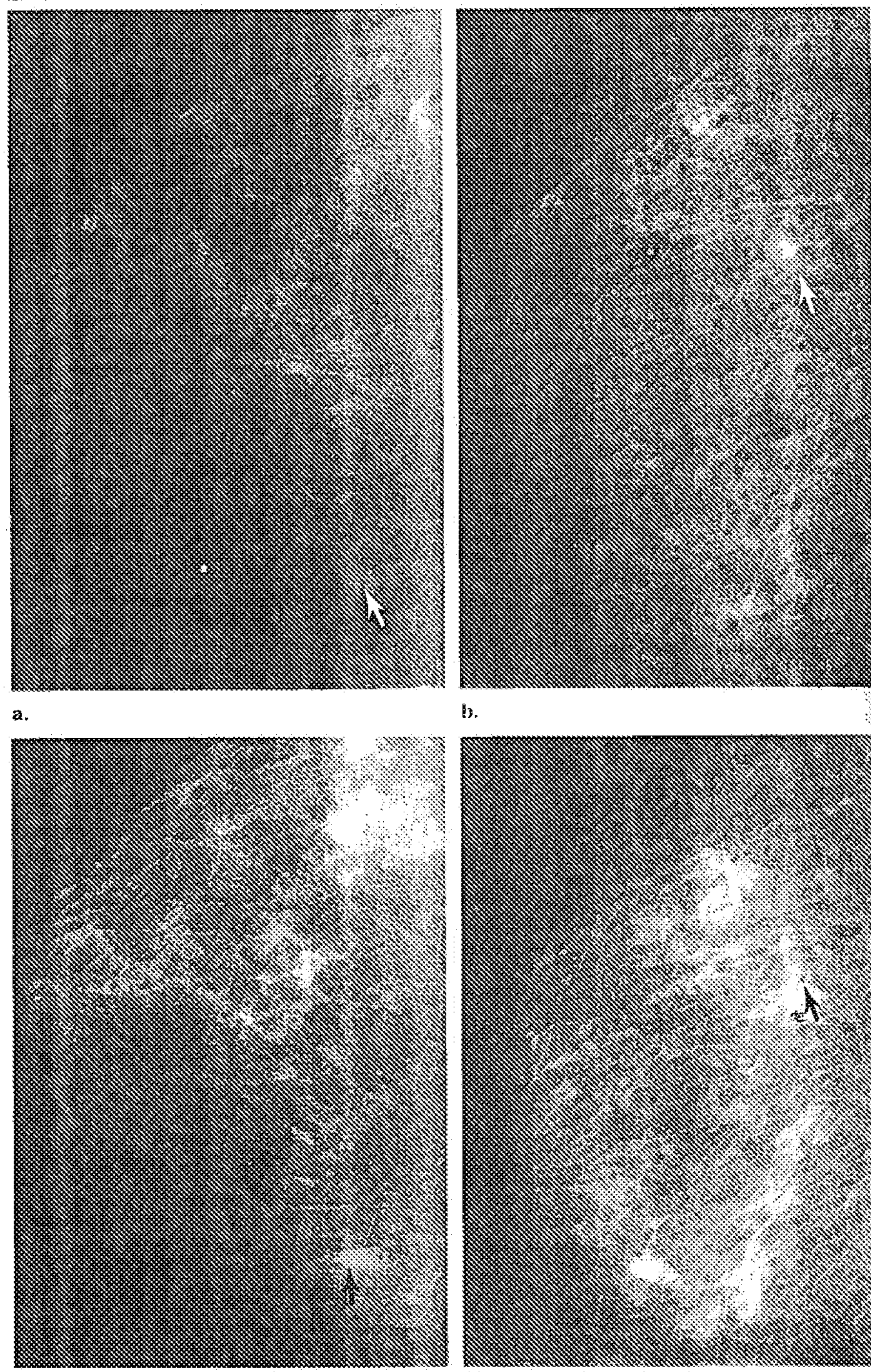
Measurements were performed by aligning the prebiopsy craniocaudal and mediolateral oblique images with the corre-

sponding postbiopsy images by using parenchymal and soft-tissue landmarks (eg, nipple, pectoralis muscle, and vascular structures). If the mammographic lesion was identified on postbiopsy images, a line parallel to the plane of compression was drawn from the center of the expected lesion to the clip, and the distance was recorded. If the lesion was seen as being excised on the postbiopsy images but if the biopsy cavity was filled with air and/or if a hematoma was identified, the line was then drawn between the center of the biopsy cavity and the clip (Fig 1). If neither the mammographic lesion nor the biopsy cavity was visible, the circumference of the original lesion was outlined on the prebiopsy craniocaudal and mediolateral oblique images by using a wax marker.

The corresponding postbiopsy image was superimposed on the prebiopsy image to allow the outline of the lesion to be shown through the postbiopsy mammogram. By using the outline of the lesion as the reference, the distance between the expected center of the lesion and the clip was then measured. The accuracy of clip placement was determined by determining the position of the clip relative to the mammographic lesion and was recorded as 5-, 6–10-, 11–19-, or >20-mm displacement from the center of the targeted lesion.

Each lesion was retrospectively correlated with the histopathologic diagnosis (categorized as benign, infiltrating breast carcinoma, ductal carcinoma in situ, or atypical hyperplasia). If presurgical needle localization was performed, the needle localization images and surgical specimen radiograph were also reviewed. All presurgical needle localizations procedures were performed by using an alphanumeric grid and a needle–hook wire system to localize the metallic clip and the residual lesion (if visible).

In general, the same plane of compression used for core-needle biopsy was used for needle localization. If there was a large discrepancy between the location of the clip and the targeted lesion on the postbiopsy images, both were localized separately. All surgical specimens were imaged at the time of surgery to confirm that the targeted lesion and the marker clip were excised. Furthermore, in all cases involving definitive surgery, the surgical histopathologic findings were also reviewed to ensure mammographic-pathologic correlation.

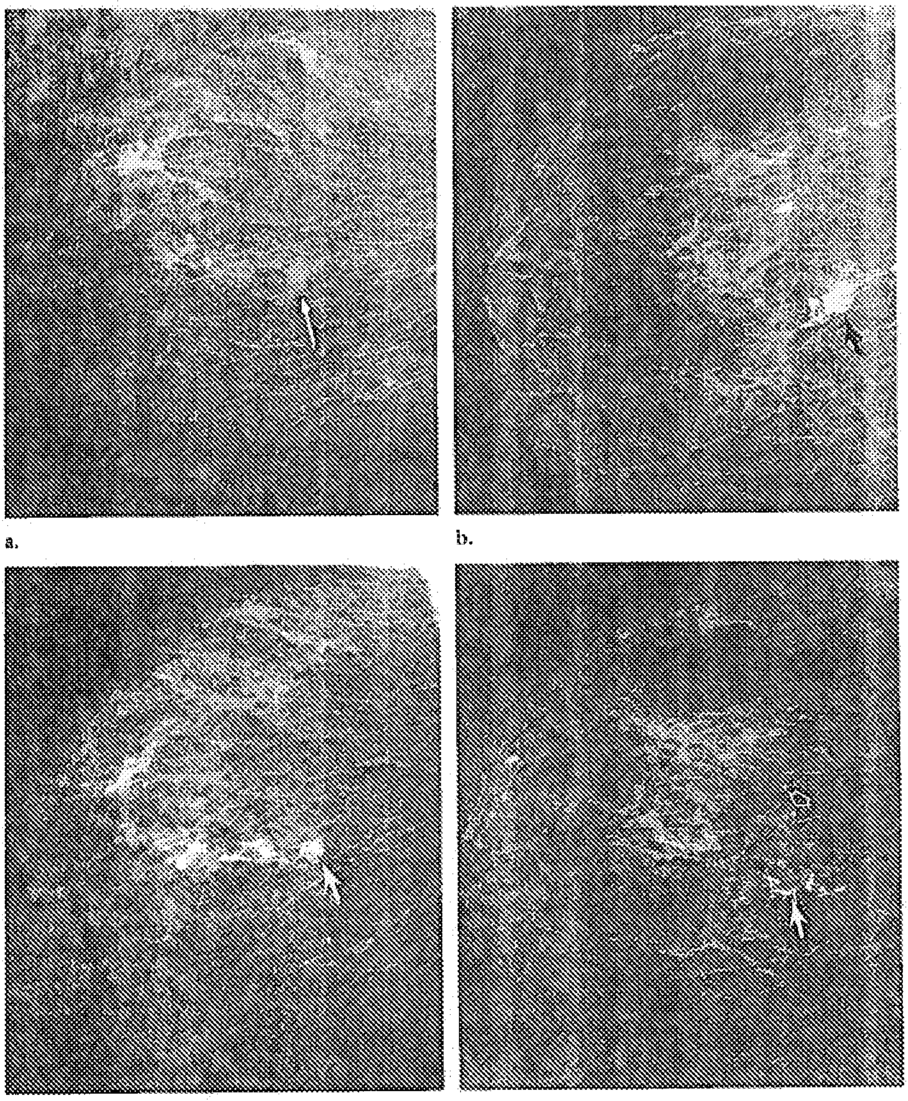


a. b. c. d.

Figure 2. Accurate clip placement on two orthogonal views. On prebiopsy (a) craniocaudal and (b) mediolateral views, the palpable abnormality (indicated by the radiopaque BB marker) at the 2-o'clock position in the right breast corresponds to a partly obscured, noncalcified, oval mass (arrow). Stereotactic vacuum-assisted biopsy was performed from a superior approach. Pathologic analysis revealed fibroadenoma. Postbiopsy (c) craniocaudal and (d) mediolateral mammograms demonstrate hematoma and air at the biopsy site (arrow). The metallic clip is within 5 mm of the biopsy site on both projections.

RESULTS

Mammographic findings of the 111 lesions were characterized as clustered microcalcification in 79 (71%), masses in 28 (25%), architectural distortion in two (2%), and developing asymmetric densities in two (2%). The mean lesion size



a. b. c. d.

Figure 3. Metallic clip displacement on only one projection. Prebiopsy (a) mediolateral and (b) craniocaudal mammograms show an obscured lobulated mass (arrow) in the central right breast. Stereotactic vacuum-assisted biopsy was performed with a medial approach, with the breast in mediolateral compression. The mammographic lesion was obscured by hematoma on postbiopsy stereotactic images (not shown). A metallic clip was subsequently deployed to mark the biopsy site. Pathologic analysis revealed fibroadenoma. (c) In retrospect, a residual mass (arrow) is evident on the postbiopsy mediolateral mammogram. The metallic clip is within 5 mm of the biopsy site. (d) Craniocaudal mammogram of the right breast obtained immediately after stereotactic biopsy shows a small hematoma at the biopsy site (solid arrow). The clip (open arrow) is displaced 25 mm lateral to the biopsy site. The displacement is only in this plane, which is perpendicular to the plane of compression at stereotactic biopsy.

was 7.8 mm (range, 2–23 mm). In 61 (55%) of 111 lesions, biopsy was performed with craniocaudal compression for either a superior or inferior approach. In 50 (45%) of 111 lesions, biopsy was performed with lateral compression for a medial or lateral approach. The mean number of specimens obtained was 10.7 cores (range, 6–27 cores). In the 111 lesions in which a marker clip was deployed, the histopathologic findings were benign in 72 (65%), malignant in 26 (23%), and atypical hyperplasia in 13 (12%). Of the 26 malignant lesions, infiltrating breast carcinoma was diagnosed in eight, and ductal carcinoma in situ was diagnosed in 18.

Retrospective review of the mammographic images obtained after clip deployment demonstrated that 28 (25%) of 111 lesions remained partially visible on postbiopsy images. Of the 28 lesions that were mammographically visible after clip placement, 14 (50%) were benign, one (4%) was atypia, 10 (36%) were invasive carcinoma, and three (11%) were ductal carcinoma in situ. In 83 (75%) of the 111 lesions examined at biopsy, the original lesion was completely removed or obscured by hematoma.

In our study, the distance from the clip to the center of the original lesion was within 5 mm on both craniocaudal and mediolateral oblique projections in 62 (56%) of the 111 cases in which marker clips were placed (Fig 2). Clip placement in 40 of these 62 cases was performed with craniocaudal compression, and clip placement in 22 cases was performed with lateral compression. In the 111 cases, the clip-to-lesion distance on at least one projection was 6–10 mm in 18 (16%) and greater than 10 mm in 31 (28%) (Fig 3). In 31 cases, the clip was more than 1 cm away from the targeted lesion on at least one projection. In 16 cases, it was 10–20 mm away; in seven, 20–30 mm away; and in eight, more than 30 mm away.

Tables 1 and 2 show the accuracy of clip deployment on at least one craniocaudal and mediolateral oblique projection at biopsy performed with craniocaudal and lateral compression. Our data suggest that the largest error occurred in the plane orthogonal to the compression plane used for the percutaneous biopsy (z axis). In 61 biopsies performed with craniocaudal compression, 60 (98%) clips were within 1 cm of the lesion examined at biopsy, one (2%) was 1–2 cm from the lesion, and no clip was more than 2 cm from the lesion on the postbiopsy craniocaudal projections.

However, on the postbiopsy mediolateral oblique mammograms, eight (13%) of 61 clips placed with craniocaudal compression were more than 2 cm from the biopsy site. Of these, three clips were more than 3 cm from the lesion. Similarly, in 10 (20%) of 50 cases in which biopsy was performed with lateral compression, the clip was more than 1 cm from the lesion; in seven (14%) cases, the clip was more than 2 cm away on the postbiopsy craniocaudal projection.

Surgical excision was recommended for the treatment of 39 lesions diagnosed as atypical hyperplasia, ductal carcinoma in situ, or infiltrating carcinoma. Surgery was subsequently performed at our institution in 35 cases. The remaining four cases were lost to follow-up because the patients either returned or were referred to another facility for their definitive surgery. Of the 35 operations performed at our institution, preoperative wire local-

ization was performed in 30. Five of the 35 operations were mastectomies.

The metallic clip was used as the target for wire localization if the clip was within 1 cm of the original lesion on both projections. If there was a clip placement error of more than 1 cm on at least one projection, appropriate adjustment was made on the basis of the radiologist's evaluation of the pre- and postbiopsy mammograms (Fig 4). All adjustments made at preoperative needle localization were clearly communicated to the surgeon. The radiograph specimen with pathologic analysis confirmed excision of the clip and the residual lesion or the biopsy site in all cases.

Of the 39 lesions requiring definitive breast cancer surgery, 25 (64%) were retrospectively not visible on the mammograms obtained after percutaneous biopsy. However, 16 of these lesions were visible on subsequent surgical specimen radiographs. Histopathologic analysis of the remaining nine lesions verified excision of the biopsy cavity and/or residual lesion.

In five (13%) of the 39 lesions, the marker clip was more than 2 cm from the original lesion on at least one projection. Of these, three were malignant, and residual tumor was identified positively at histopathologic analysis of the surgical specimen. One of the five cases was lost to follow-up. One case of atypical ductal hyperplasia demonstrated no residual disease at surgical excision. The gross surgical specimen of this case measured 6.4 × 4.7 × 2.7 cm; a 0.4-cm hemorrhagic area, which indicated the previous biopsy site, was identified. Mammographic follow-up demonstrated stability of this case during the 2 years since biopsy.

In four (10%) of the 39 lesions requiring surgery, ductal carcinoma in situ and infiltrating breast carcinoma were later documented at surgery for two atypical ductal hyperplasia lesions and two ductal carcinoma in situ lesions that were diagnosed at stereotactic vacuum-assisted biopsy.

DISCUSSION

In our study, marker clip deployment was included in nearly half (111 [43%] of 258) of all stereotactic vacuum-assisted biopsies performed during the study period. The majority of these cases (72 [65%] of 111) were proved to be benign at histopathologic analysis. In retrospect, 28 (25%) of 111 lesions and 14 (19%) of 72 benign lesions were partially visible on the postbiopsy mammograms and theoretically may not have required a marker clip. The stereotactic images obtained after biopsy, however, were often limited due to their small field of view, poor compression, overlapping shadow of the biopsy probe, and obscuring hematoma. Because the decision whether to deploy a clip was based on the assessment of stereotactic images, we found that many clips were placed when the lesions were not visibly excised. Thus, careful attention to digital image optimization is one possible way to reduce unnecessary clip deployment.

Although a substantial number of cases requiring additional surgery demonstrated discrepancies between the location of the clip and the biopsy site, needle localization and excision were performed successfully. We believe that this success was likely related to our routine evaluation of the postbiopsy images and the prospective identification of inaccurate clip placement. Appropriate compensation was made during needle localization, which allowed successful surgical excision of all 30 surgical lesions in our series. In 15 (50%) of those 30 lesions, the clip was 1 cm or more from the biopsy site on at least one projection.

In our study, in all cases in which the clip was more than 2 cm away from the biopsy site, the discrepancy was evident in the plane orthogonal to the compression plane used for biopsy (z axis). Therefore, the importance of obtaining routine orthogonal-view screen-film mammograms after biopsy is twofold.

First, the final position of the marker clip is more accurately evaluated on screen-film mammograms than on stereotactic images. If there is an error in clip placement on one or both projections, the clip position and the distance away from the biopsy site can be clearly documented in the procedure report to ensure successful needle localization if definitive breast surgery is required. This documentation is particularly important if needle localization is performed at another institution or by another radiologist who is not familiar with the case. It is also important in cases in which the lesion is excised at stereotactic biopsy and residual hematoma and/or air is no longer identifiable at the time of needle localization.

Second, knowledge of the location of the clip in relation to the biopsy site on a two-view mammogram would aid in planning needle localization, since localization is most often performed with mammographic guidance. Because clip placement is most accurate in the plane used for percutaneous biopsy, we recommend performing needle localization in the same compression plane used for stereotactic biopsy to minimize sampling error at surgery. If there is substantial clip displacement, depth compensation can then be made in the orthogonal plane. Alternatively, Brenner (8) recently suggested that preoperative localization of excised lesion with the freehand technique, in which mammographic landmarks are used, may be a feasible option when there is a clip placement error. However, this type of localization requires sufficient experience with the freehand technique to ensure accuracy.

Previous study findings (4–6) on metallic clip placement during 11-gauge stereotactic core-needle biopsy, like ours, suggest that these clips provide an accurate and reliable method for marking the biopsy site when the mammographic lesion is no longer visible after biopsy. They also confirm that the metallic clip can be used as an accurate target when subsequent preoperative needle localization and surgical excision are indicated. However, several differences between our study and the previously published ones deserve comment.

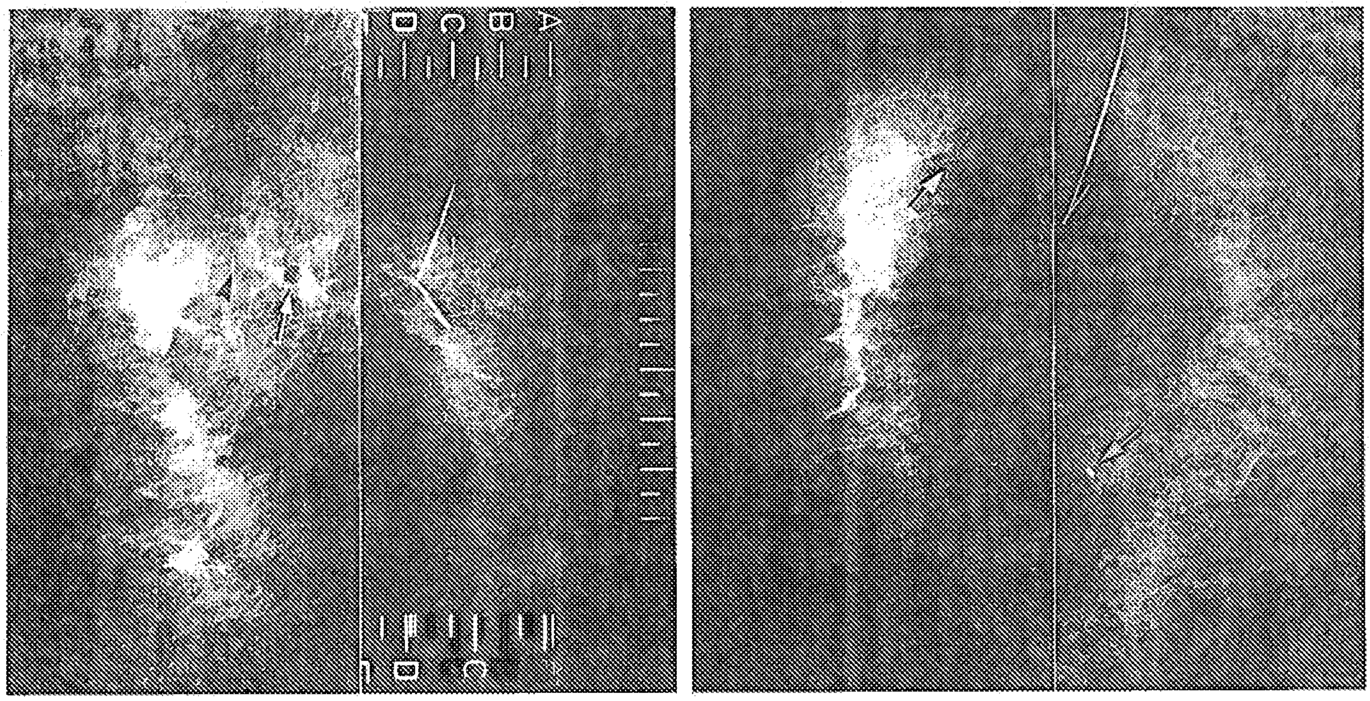
Both Liberman et al (4) and Reynolds (5) evaluated the accuracy of clip localization after stereotactic vacuum-assisted breast biopsy by comparing target and

TABLE 1
Accuracy of Clip Deployment at Breast Biopsy Performed with Craniocaudal Compression

Distance of Clip from Biopsy Site (mm)	No. of Clips ($N = 61$) Craniocaudal Projection	Mediolateral Oblique Projection
≤5	53	43
6–10	7	5
11–19	1	5
≥20	0	8

TABLE 2
Accuracy of Clip Deployment at Breast Biopsy Performed with Lateral Compression

Distance of Clip from Biopsy Site (mm)	No. of Clips ($N = 50$) Craniocaudal Projection	Mediolateral Oblique Projection
≤5	24	41
6–10	9	6
11–19	10	3
≥20	7	0



a. b.

Figure 4. Presurgical needle localization adjusted for clip placement error. A 49-year-old woman had a cluster of pleomorphic microcalcifications in the right posterior breast at the 10-o'clock position. The patient subsequently underwent stereotactic vacuum-assisted core-needle biopsy with lateral compression. All calcifications were removed, and a metallic clip was deployed to mark the biopsy site. Pathologic analysis revealed atypical lobular hyperplasia. **(a)** Left: Mediolateral mammogram obtained immediately after stereotactic biopsy demonstrates an air-containing cavity (arrow) at the biopsy site. The clip (arrowhead) is displaced approximately 10 mm from the site. Subsequent needle localization was also performed with a lateral approach. By using parenchymal landmarks, the original biopsy site was targeted. Right: Needle localization lateromedial projection obtained on an alphanumeric grid confirmed that the localizing wire is close to the original biopsy site. **(b)** Left: Prebiopsy craniocaudal mammogram demonstrates the original cluster of pleomorphic microcalcifications (arrow) in the posterior lateral right breast. Right: Corresponding needle-localization craniocaudal view is a mirror image of the mammogram. The metallic clip (arrow) is displaced approximately 7 cm medial to the biopsy site. By using parenchymal landmarks, successful needle localization of the original biopsy site was performed by compensating for depth error in this plane. Surgical histopathologic analysis yielded atypical lobular hyperplasia without evidence of carcinoma.

clip coordinates obtained from stereoradiographs. On the other hand, we relied on the measurement of clip-to-target and/or clip-to-biopsy site distances on dedicated screen-film mammograms obtained immediately after the biopsy. Although Liberman et al and Reynolds reported a much smaller percentage of cases with a clip-to-lesion distance greater than 1 cm compared with ours, the discrepancy is likely due to the different methods used to assess clip placement.

In fact, in our study there were only four (4%) of 111 cases that demonstrated clip-to-target distances greater than 1 cm in a plane other than the z axis. Liberman et al (4) and Reynolds (5) compared the stereo coordinates of the clip with the coordinates of the targeted lesion. The advantages of this technique are that it is quick, it is easily reproducible, and it provides measurements in the x, y, and z axes. The limitation, of course, is that these measurements are obtained while the breast is compressed, and small discrepancies, particularly in the z axis, may translate into larger distances because of the so-called accordion effect when the compression is released (4–6). Thus, even if the coordinates of the clip are close to the target and/or the biopsy site, a larger distance may be observed in an orthogonal plane postbiopsy mammogram. Although in both studies they commented on this phenomenon and recommended the acquisition of postbiopsy dedicated screen-film mammograms to avoid underestimation of the true distance between the biopsy site and the clip, they did not report these distances. We relied on direct measurement of the clip to the biopsy site, as demonstrated on the postbiopsy mammograms, so that displacement in the z axis was not underestimated.

Burbank and Forcier (6) used a mask measurement system to evaluate the location of the clip relative to the lesion examined at biopsy on dedicated screen-film mammograms. Their mask measurement system involved the creation of a mask by drawing localizing markers and the targeted lesion on the prebiopsy images in both projections onto clear films. The mask was then superimposed onto the postbiopsy image, and the position of the clip was drawn on the mask. Masks were created in both projections, which resulted in two masks per lesion undergoing biopsy. They then measured the distance from the clip to the center of the lesion on both masks and calculated the mean to determine the mean distance off target. Realizing that there would be some variability due to differences in technique, the authors also developed a calibration system based on mammograms of control benign lesions. Thus, they calculated the true distance between the clip and the lesion as the mean distance off target minus this correction factor. This mean, however, results in underestimation of the maximum clip-to-biopsy site displacement.

Although in both their study and ours

postbiopsy mammograms were used to measure the distance between the clip and the lesion, we did not use the mask measurement system. Instead, we chose a direct method of measurement when the biopsy site or residual lesion was visible. We used superimposed images when this was not possible. We then measured the distance from the center of the lesion and/or biopsy cavity to the clip in both obliquities instead of the mean of the distances. Therefore, we have a higher percentage (14% [15 of 111 clips] vs 7%) of clips placed by using the through probe technique that are greater than 2 cm from the biopsy site.

Our data reflect the maximum distance in either projection, not an average. We used this system for several reasons. The most important reason is that the true discrepancy between the clip and the biopsy location almost always occurs in the z axis. Therefore, a large z-axis discrepancy may be underestimated if it is averaged in the same case where there is small or no x- or y-axis discrepancy. In our study, all cases in which there was a large (>2-cm) discrepancy in the location of the clip versus the biopsy site, the displacement occurred in the plane perpendicular to the biopsy compression plane (z axis). In our study, we used a measurement system that reflected clinical practice and that closely illustrated the maximum clip displacement when present.

When the differences in the design of three studies are taken into account, the results are actually comparable. In our study, 75% of the lesions examined at biopsy performed with an 11-gauge mechanical cutter were not visible on postbiopsy mammograms. This finding is similar to the 72% of excisional biopsies reported by Burbank and Forcier (6). Liberman et al (4) reported that 71% were completely excised, although she reported an additional 10% that could not be evaluated due to obscuration from hematoma. In addition, our study findings demonstrated 15 (14%) of 111 lesions in which the location of the clip relative to the target was greater than 2 cm in one direction and eight (7%) that were greater or equal to 2.5 cm. This finding compares favorably with the 7% in Burbank's study in which the mean distance off target was greater than 24 mm. All study findings demonstrated a high degree of accuracy for clip placement in the x- and y-axes.

In conclusion, our study findings demonstrate that the location of the metallic clips deployed during stereotactic vacuum-assisted breast biopsy may differ substantially from the actual biopsy site, as demonstrated on dedicated postbiopsy screen-film mammograms. This discrepancy is typically in the plane perpendicular to that used for compression during biopsy (z axis) and is most likely due to the accordion effect (4). Although these clips are useful for marking a biopsy site when the visible portion of the lesion has been removed, careful correlation between the biopsy site and clip locations on two orthogonal mammographic images should be routinely performed after biopsy. These images will depict any discrepancies and allow accurate needle localization if it is subsequently required.

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